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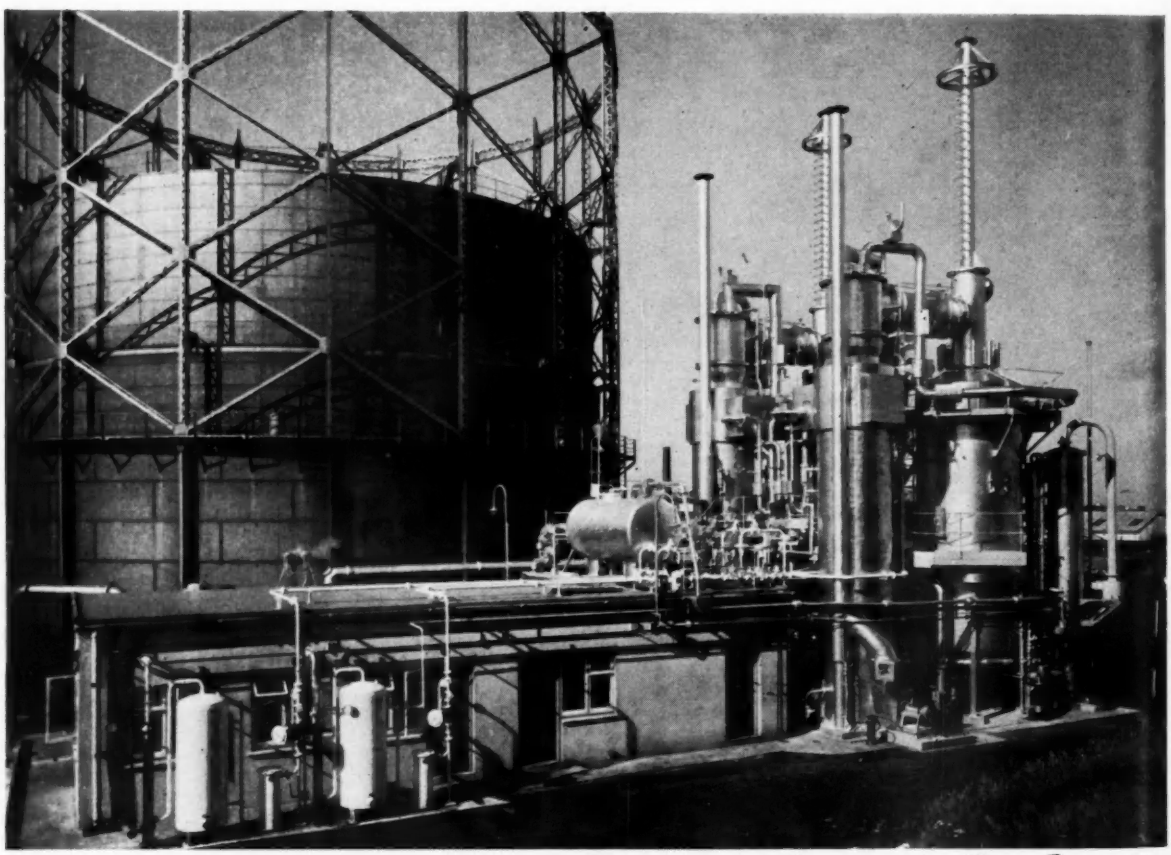

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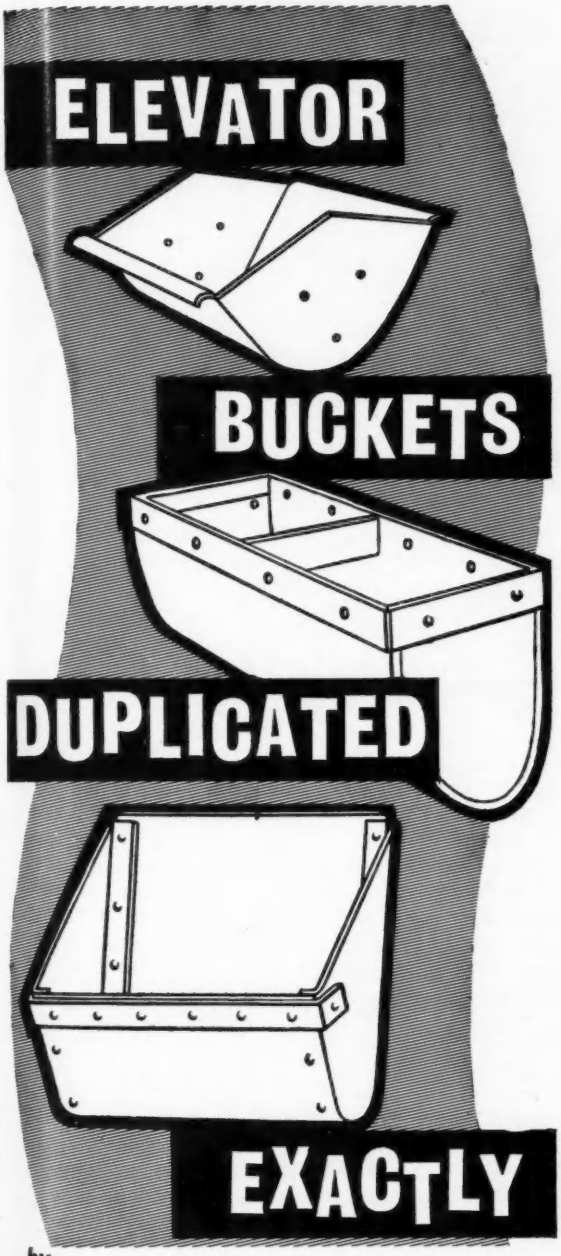

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Gas Journal

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Fuel and the Common Market

GREAT BRITAIN'S decision to seek membership of the Common Market—the European Economic Community, or E.E.C.—and the effect it might have on the country's fuel industries does not appear to have called for much comment so far. There are so many other aspects of this unique step by the British Government, mostly political, and these may well have swamped any considerations outside the most obvious.

That it will have its effect on the fuel markets in this country is clear enough and the only reaction so far appears to have been expressed by Lord Robens, Chairman of the National Coal Board, who optimistically pointed out that such a step would greatly improve the sales of British coal on the Continent of Europe.

Recently a series of articles has appeared in *The Times* under the general heading of 'The Future Shape of the Common Market', which has dealt with the possible changes that might come about to make possible the entry of the British economy, if its application for membership was accepted by the 'Six'. In one such article recently the subject specifically dealt with was 'Towards a European Policy for Fuel'. Its appearance, we feel, is most timely, since it does at least help us to get into our minds Britain's existing relationship with those fuel organisations already set up in Europe.

We may well ask ourselves whether a fuel policy is not needed at home before Britain can think of becoming a full member of the Continental fuel organisations, since whatever relationship with them it now enjoys, it would have to take full part if it joined E.E.C.

E.E.C. is in fact one of three interlinked European Communities, the others being the European Coal and Steel Community and Euratom, with both of which Britain is already associated. By becoming a full member of E.E.C., Britain would simultaneously become a full member of the other two.

Since each of these latter are concerned with organisation, sales and research of solid fuel and atomic energy respectively—and a department of E.E.C. itself looks after oil matters—Britain's tie-up in fuel matters with the Continent is likely to be fairly clear from the start. It should not cause many, if any, seemingly insoluble problems, such as those raised in other quarters where Commonwealth relations and our relationship to Efta are concerned. By becoming part of a community, however, Britain's own position will radically change, and it will no longer have the complete freedom of action in fuel matters it has enjoyed hitherto.

The importance to Germany and Belgium of selling their coal, has caused the discussions on fuel and power matters among the original members of E.E.C. to be dominated by a coal caucus, and this seems likely to have its effect on Britain. It might well take the form of Britain having to compete with German and Belgian coal in its own home markets. On the other hand it is generally thought that Britain's traditional Continental coal markets extending from the west coast of France to the Baltic Coast of Germany would revive, given the right grade of coal at the right price.

If, however, other Efta countries joined the Common Market with Britain, it might be easier to balance out coal producers and coal importers, and the effect of the coal caucus would become less marked.

Oil supplies to the community may raise certain difficulties and will need some careful smoothing out. Sources of available oil would include British-owned concerns as well as the existing Italian oil firms. France, however, is likely to want to press its claims to include Algerian oil, and Britain might equally well want to include Trinidad as a source of supply. Russia is known to have a surplus oil production and is anxious to sell it abroad. British trade behind the Iron Curtain might well depend on its readiness to import Soviet oil. France has already reacted violently against Holland bringing in oil from the Common Market's associated territory of the Netherlands Antilles.

Superficially, therefore, it would seem that the prospects open to Britain, at any rate where fuel is concerned, may be promising in the long run, though in the early stages a firm but tactful handling of the rival national interests will be necessary.

The British gas industry is clearly interested in both coal and oil and is likely to welcome any move which will cheapen them. Today's trend away from the use of crude fuels by the householder as well as industry should increase the demand for refined fuels.

The next step, therefore, should be to make available a cheaper gaseous therm, one in fact which is fully competitive with oil or electricity.

The importance of the cheap gaseous therm is further

accentuated when it is realised that the transmission of gas is, so we understand, considerably more economic than transmitting the equivalent thermal quantity of electricity.

The proposal to bring liquefied natural gas from Algeria to Britain by tanker should be helpful, but if the quantities so shipped should increase enough to have a significant effect on the price of distributed town gas in Britain, the political repercussions which would follow are likely to be serious, and a substantial coal market might well be in jeopardy.

Would Britain's membership of the Common Market help in any way to bring about, more or less, if not completely, painlessly, an increased use of natural gas?

We have seen that although Britain may have to give and take in the European coal markets, it is at least the forecast by the Chairman of the National Coal Board that the country's coal exports might increase substantially.

We know that the French coal industry is far smaller than its British counterpart, and that from the earliest days of an organised coal export trade, British coal has been exported to France; and this despite Continental coal fields near her own frontiers.

By becoming a full member of the European Coal and Steel Community, not only will Great Britain become part of a far larger potential market with four to five times the population, but might well be able to balance the sales of solid fuel with the purchase of the more flexible and far more acceptable natural gas.

Should these purchases increase to the kind of totals for the consumption of natural gas now being realised in France, the need for a direct connection by main might be necessary.

Value of Channel tunnel

Without allowing our imagination to soar to impossibly impractical heights, we feel that the need for a bridge or tunnel across the English Channel might soon become a necessity. Tourism might be made to pay the charges on the large capital sums which would be needed, so enabling freight charges on goods passing in each direction to be maintained at a reasonably low figure; at the same time a means of effectively carrying gas mains and electricity cables would be ready to hand. A physical connection such as this would be something of a breakthrough in promoting Anglo-Continental fuel exchanges.

Our competitors, the electricity industry, would of course gain considerably by a sea-crossing of this kind in that power exchange could be made direct from either side of the Channel without the need for converting a.c. to d.c. and *vice versa* before and after it entered the submarine cable, if this was not in direct contact with the sea-bed.

Coal is therefore likely to play an important part, directly and indirectly, in obtaining the full advantages which might accrue from Britain's membership with the Common Market. A preliminary skirmish or two might be necessary before the kind of exchange we have attempted to outline could be realised. Clearly agreements would have to be reached between German and Belgian coal interests, but the very high quality of British coal—and we believe that its price is below that of Continental coal—would form a sound basis for negotiation with Continental producers. In some way such as this a supply of natural gas might be obtained from abroad and its entrance into this country in quantity might be acceptable to all concerned, including the mining industry.

Although over the last few years the demand for coal on the Continent may have fallen in the same way as it has in Britain, and the E.C.S.C. may be facing difficulties in disposing of its stocks, should the situation change and a coal shortage in Europe develop, the British industry would share all the advantages to be gained from being compelled to put its resources at the disposal of the Community. Thus all coal-producing countries would benefit.

Atomic energy

Atomic energy will have to be considered in any review of the European fuel situation. Euratom was established after the E.C.S.C., which had originally been looked upon as the body on which European fuel policy would be based. A separate organisation was considered necessary to look after the novel and peculiar problems of this new power source. Great Britain has always been associated with the Euratom organisation since its formation, but on becoming a member of the Common Market, its relationship would become far closer and all atomic energy knowledge Britain now possesses would have to be shared.

This is a difficult situation for Britain because the peaceful uses of atomic energy are more developed here than anywhere else in Europe—and possibly in the world—and also because many facts and figures connected with the military uses are secret and can only be shared with the United States of America.

Britain is therefore likely to lose by joining Euratom, or at any rate not gain anything by it. In fact this country has a great deal to contribute to the common pool of European atomic energy knowledge and expertise. If the entry of Britain into the Common Market is only going to be possible after a great deal of bargaining, its potential contribution to Euratom might be the strongest card it holds, and might well sway the 'six' into accepting its terms for entry.

As regards Britain's undertaking with the United States, any move on the part of E.E.C. to demand to share these secrets would be resisted and, if made, might cause a very unfavourable reaction across the Atlantic. In fact so serious a view might be taken by both Britain and the U.S.A. that Britain might be unable to join Euratom as a full member, if such conditions of membership were insisted upon.

It seems likely, however, that with a little ingenuity the dividing line between the civil and military uses of atomic energy and the particular facts appertaining to each, could be drawn to the satisfaction of both sides.

Britain undoubtedly has a number of useful fuel assets to offer E.E.C. and provided these can be exploited to the full, if and when full membership is achieved, it appears that its fuel industries would, on balance, benefit from entry into the Common Market.

Shropshire tar and natural gas

By M. SCHOFIELD, M.A., B.Sc., F.R.I.C.

ALTHOUGH the Shropshire leadership in the iron industry has been fully reviewed, with the pioneer work of the three Abraham Darbys acknowledged universally, the Coalbrookdale area has been the scene of other striking chapters in the history of technology.

The 250th anniversary of Abraham Darby II brings to mind that in the same year 1711, for example, there was observed a surprising 'natural phenomenon' known as the 'Burning Well of Jackfield,' or the 'Inflammable Well at Broseley.' Here was the beginning of natural gas history for this country; an event on Severnside which aroused as keen an interest as when Humphry Davy discovered the gas at Pietramala, the Apennine village where Davy, accompanied by Faraday on a European tour, analysed the gas causing the flaming jets, and pronounced it 'a hydrocarburet pure.'

This early recording of natural gas at Jackfield, near Broseley, was preceded by the discovery of a natural bitumen spring at Pitchford, which also attracted the curiosity of writers just 300 years ago.

The 'tar tunnel'

At Coalport there was another discovery—the 'tar tunnel,' which provided 1,000 barrels per week of natural bitumen. To round off the contributions of this Shropshire area to the story of tar distillation, there came to the industrial peninsula of Severnside that pioneer of coal tar, the Earl of Dundonald.

With so much coal carbonised for the Coalbrookdale furnaces there was naturally ample tar for setting up the Calcutts works by Dundonald. This followed the patent granted to him in 1781 and his work at Culross. Dundonald had certainly a pattern or pilot plant set up for him by those experimenting with natural bitumen; for local records tell of extracting from it 'naphtha (*sic*), rectified naphtha, gas to illumine our houses, and those magnificent colours derived from the sun's rays when the earth was young and green.'

Fifty years before the Jackfield methane well was discovered, the Pitchford bitumen spring appeared in the local gossip.

'In a private man's yard there is a well whereon floweth a thick skum of liquid bitumen, which being cleared and taken off one day, will have the like again on the morrow,' wrote local historian, Randall, quoting some recorder of 1660.

As was the case with the first application of petroleum, the bitumen was regarded as beneficial in medical fields, with 'druggists and gentlemen of the medical profession sending for it from great distances.'

'Try whether this bitumen be good for falling sickness and have a powerful property to draw and close up wounds, as that in Judea is known to have' was the exhortation.

Bitumen from nearby Tarbatch Dingle had long been claimed to have such properties, with 'old dames and village sages, assuming the wisdom of Hippocrates as to their qualities,' dipping weak children nine times as a magic cure!

'The tar itself, which oozed out of the rock and formed a thin skin on the surface of the water, had special merits of its own, and was collected both here and at Tar Tunnel for exportation.'

The Pitchford spring yielded 'an oily unctuous matter on the water, one good to comfort the nerves, supple the joints, dry up rheumes, and dry up palsies and contractions.' A century before Canadian oil wells were discovered, reported Randall, a Canadian named Holmes visited the region, and as representative of an oil company, 'entertained sanguine hopes of being able to turn them to account as a commercial proposition.'

At the end of the 17th century and just prior to the discovery of Jackfield natural gas, a further report on Shropshire bitumen appeared in the *Philosophical Transactions of the Royal Society* (1697, p. 544).

This 'Account of the making of Pitch, Tar and Oil out of a blackish stone in Shropshire' was contributed by Martin Ele, who used a mill (then known in the glass industry for grinding flints) for reducing the blackish rock or oil-bearing shale found in the Broseley coalfield.

He boiled the powdered rock with water, separated a bitumen, and obtained also an oil which could be used to dilute the bitumen to yield a tar. Ele specified this tar for preserving timber or ships, claiming to have used it himself for this purpose.

This use of natural bitumen or tar for boat-builders preceded the application of Dundonald's tar for Severnside trows or flat-bottomed boats.

Places of promise

In the heyday of production a number of places in the district gave promise of being rich sources of bitumen and petroleum seepages. At Priors Lee a shaft was sunk and a tar well formed at the bottom, oil being drawn up in buckets and stored in vats or cisterns at the top, yet only at the rate of a few gallons per day.

Gradually the first optimism declined as did the supplies, the Coalport tar spring dwindling from a thousand gallons per week to only a few gallons.

At some point in history the flourishing boat-building industry of Severnside changed from using natural bitumen or tar to substitute tar from the Dundonald ovens.

For some 30 years the Broseley area also had a link with methane history, beginning two and a half centuries

ago. In journals of the period the burning well was described as being some 60 yards from the Severn and was discovered by 'a poor man living near, who being alarmed with an uncommon noise in the night, went to the place with a lantern.'

He dug at the spot, noted water gushing forth with violence, and found a gas which caught fire from his lantern. Later he damped it down, 'enclosing it with a praun and dow and leaving a hole to collect the flame, which he might light and extinguish at his pleasure, and made considerable profit from the company resorting to see it.'

This commercialisation continued for some years until the flame grew weaker and no more gas was evolved. In 1747 the same man found a new vent some yards from the first, this also burning with a flame 'so intense as to boil a common tea kettle in about nine minutes.'

Mutton steaks and slices of bacon were cooked at the spot, this despite the alternate gushing of water with the gas. Four years later a coal-pit was begun nearby, an operation which brought a spectacular end to the methane source at Jackfield.

Subterranean reservoir

The workmen excavating the pit first met burning gas and then a subterranean reservoir of brine. This they drained, found a sulphuretted hydrogen smell in the gas below, and set fire to the latter. The resulting explosion 'shook windows and even the casks in the cellar. This seemed the dying groan of the burning well, for since that time it has entirely ceased to burn.'

In this same Shropshire region the early tar-distillation industry set up by Dundonald soon after 1782 proved an interesting sequel to the finding of natural gas and bitumen.

Dundonald had appreciated while serving in the Navy the urgent need for preserving ship bottoms from woodworm. He had pondered over the possible use of tar from coal for this purpose, the young earl 'gleaning from his venerable father a knowledge of chemistry,' as historian Randall put it.

In 1781 came first efforts on a small scale production of tar; then his patent for 'extracting or making tar, pitch, essential oils, volatile alkali, mineral acids, salts and cinders from coal.'

Up to that point failure came to others who had experimented on tar production, as instanced by a Bristol man taking out a patent for extracting tar from pit coal, the patentee charging a shilling per barrel distilled.

Expensive process

In the *Chemical Essays* of Richard Watson is a reference to this effort, failure coming 'in one very material article, that the expense of the process was considerably greater than would allow the tar made to be sold at the price of foreign tar.'

Even Dundonald was threatened with bankruptcy in his first commercial tar production, although this was avoided when he found partners for his British Tar Company.

Dundonald succeeded in coal distillation 'without admission of external air,' his process using ovens with one condenser serving for a pair of ovens, and intermediate condenser being a long leaden cistern filled with water.

Condensed liquors passed via wooden pipes to a storage pit and hence to a still, each still being worked for a 4½-day period when 'tar' was to be the residue in the still, or a 5½-day period when 'half pitch' was to remain.

'Volatile spirit,' or ammonia, was taken by chemists for hartshorn, while 'oil and spirits' were intermediate products.

From 20 kilns established at Culross the Earl of Dundonald was 'encouraged to proceed in establishing the manufacture upon a very large scale in different parts of the country,' one of these being the Broseley spot known as 'the Calcutts.'

He had composed a full 'account of the qualities and uses of coal tar and coal varnish, with certificates from shipmasters and others,' listing many products from coal such as coke, ammonia, sal ammoniac, Glauber's salt, and tar for ship bottoms, buoys, anchors, and for roofs.

At the Calcutts works, where two iron furnaces for producing 'gun iron' had been installed, Dundonald set up a row of 'stew coal ovens,' extracting about 4 lb. tar per cwt. of coal.

From the ovens the gases and vapours passed to 'a capacious funnel' of brick covered with lead, 'and formed into numerous gutters for the conveyance of water, the chill of which was required to condense the tar.'

There were problems or growing pains as was the case at Culross; thus we hear of gas at times exploding and 'blowing up the solid masonry around.'

On looking back to this Shropshire tar production one appreciates why Dundonald was so pleased with the venture, even more than with the Culross works, describing the Severnside works as 'the only productive, properly placed, and constructed tar works in the whole country.'

There were ample coal supplies from the Shropshire coalfield; a considerable production of coke called for in the 'cradle of the world's iron industry,' a constant demand for tar for the flourishing river traffic, and a good market for 'volatile oils and solvents' for the nearby Black Country japanning trade.

Coal handling from store to boiler

THE installation of mechanical coal handling can, in almost all cases, save money and at the same time ease labour problems. Furthermore the removal of routine hard labour in shovelling coal and the elimination of dust and dirt will attract men to the boilerhouse who can take a more technical interest in the efficient operation of the plant.

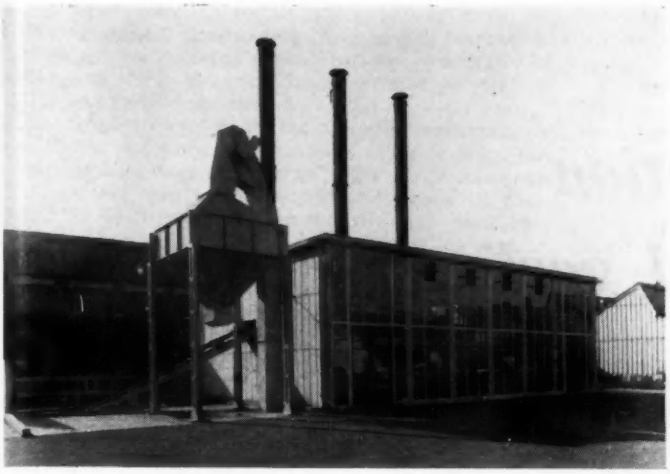
The Combustion Engineering Association felt that there was no information readily available to the industrial fuel user from which he could see the various ways in which mechanical coal handling could be achieved, and also assess the type and price of installation most suited to his particular requirements.

It was therefore, decided to produce a small booklet which would meet this need, and a Committee of experts was formed which included representatives of the National Coal Board, the Mechanical Handling Engineers' Association, the Institute of Heating and Ventilating Engineers and a consulting engineer.

The booklet shows in diagrammatic form eight typical schemes of coal handling from store to boiler, with a brief description of the equipment and the approximate cost of plant and installation.

The schemes vary from the simplest equipment for a small industrial boiler with a steam evaporation rate up to 5,000 lb/hr. costing approximately £230, to plant for boiler installations of up to 35,000/40,000 lb/hr. evaporation, costing, with bunkers and civil engineering work, in the region of £7,800.

Copies of the booklet can be obtained from the C.E.A., 70 Jermyn Street, London S.W.1., price 2s. 6d., post free.



Coke boilers heat stores and workshops

The boiler house.

REPAIR and maintenance of gas cookers and other appliances for the whole area of the South Eastern Gas Board are carried out at the stores and workshops of the Board in the Old Kent Road, London.

These premises were originally heated by steam from Lancashire boilers, but when the boiler house was replaced because of reconstruction, it was decided that the heating of the stores and workshops should be from a separate installation.

Finally it was decided that for the small steam loads needed for process work two gas boilers would be sufficient, but the most economic method for the main heating load would be by a plant burning gas coke.

Eventually three Redfyre Emma magazine boilers, each with a rating of 3 mill. B.t.u. per hour, were installed to provide heat for the low pressure hot water heating system.

The three main steel chimneys are fitted with separate stabilisers, and air for combustion is admitted to the boiler house by means of inlet louvres in the boiler house wall.

The boiler house is on ground level with an outside fuel bunker from which coke is fed by a conveyor belt into the boiler house.

A control panel shows the various flow and return temperatures from each boiler, as well as the head of water on each pump. Carbon dioxide and flue gas temperature recorders are to be fitted.

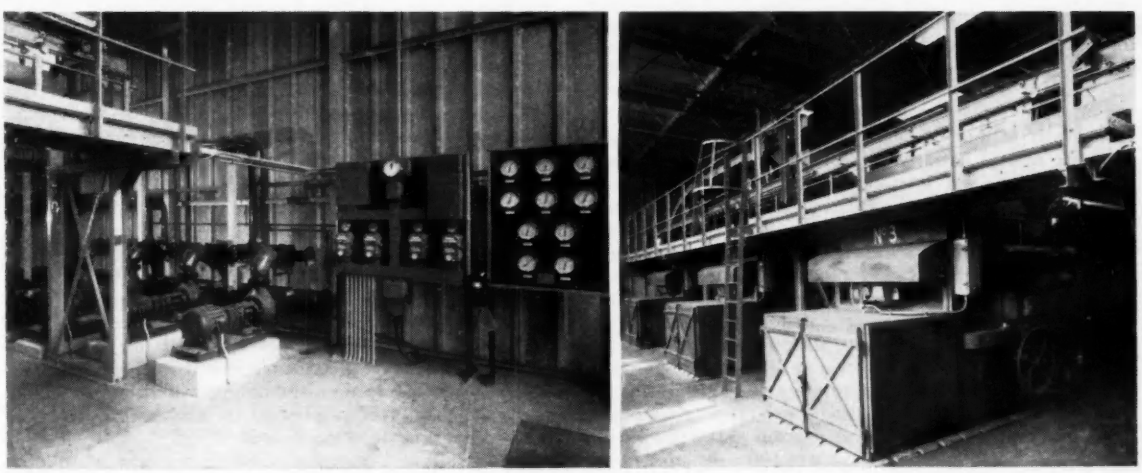
Although the total rating is 9 mill. B.t.u. per hour, an hourly consumption of coke of approximately ½ ton, the boilers are refuelled and de-clinkered only twice in 24 hours. The clinker is pushed forward by a ram into a container and left to cool until the next clinker pad is ready for removal. The boiler doors are then opened and a trolley is run under the clinker bin, which is then wheeled to the chute. The clinker is fed into an overhead hopper by a conveyor belt.

When the plant was first started the coke had to be stored out-of-doors without a cover, and the coke consequently had a very high moisture content, with a tendency for condensation to form in the boiler and flue during idling periods. This has shown that flue gas temperatures below 200°F. should not be used, otherwise condensation will set in.

Under normal conditions and with dry coke, and complete shut-down to idling dampers will be sufficient to maintain a water temperature above 100°F. During very cold weather it may be necessary to have thermostats and forced draught fans operating on a night flow water setting of, say, 100°F. This will prevent any freezing at the extremities of the system.

With three boilers running, the temperature in the boiler house remains in the lower seventies, and the radiation loss from the boilers is extremely low.

This article was abstracted from 'Gas Coke News.'



The instrument panel (left) and the boilers with overhead feed.

Cathodic protection for underground gaslines

By Peter W. Sherwood, White Plains, New York.

CORROSION is an electrolytic phenomenon. The corroding metal is at higher potential than its surroundings. Accordingly, there will be a flow of electricity away from the metal, leaving the metal in ionised (oxidised) state. Chemical combination with oxygen from the surroundings must occur simultaneously for electrical balance.

There are two ways to offset this tendency: (a) Obstruct the flow of electricity by forming an insulating layer around the metal, which can be accomplished by protective coatings, or the use of film-forming inhibitors, and (b) lower the electric potential of the metal at least to that of the surroundings. This is the course taken by cathodic protection and its application is the subject of the present discussion.

In gaslines, corrosion may be caused by exposure to (i) air and other gases; (ii) water and corrosive chemical fluids; and (iii) the soil—where we actually find a combination of salt-bearing water and oxygen at work.

Cathodic protection may theoretically be applied for any of these situations. However, protection against corrosion by conditions (i) and (ii) may usually be provided by less costly means—though the approach to the categories differs radically. Corrosion in the soil is the big, though not the only, field of cathodic protection.

Comparable costs

Here, both investment and operating costs of cathodic protection often compare favourably with other means for combating corrosion. Sometimes, the cathodic method is used by itself, sometimes in conjunction with other approaches, such as coatings. Such combinations, and various economic considerations involved, will be discussed later in this article.

Of the several basic types of corrosion (uniform, local, point, selective, and inter-crystalline corrosion), point or pit corrosion represents the greatest danger to underground metallic structures of gaslines—such as pipelines, storage tank bottoms, underground cables, and structural supports. In corrosion of this type, only a small area is attacked but the rate of penetration is high.

This type of corrosion is very definitely remediable by cathodic protection. Similarly, the method is applicable to uniform and to local corrosion which also occur in some degree, though they constitute a lesser problem.

Briefly stated, complete cathodic protection is provided when the impressed potential at a given area offsets completely the potential difference which is set up by the actually occurring corrosion. The impressed potential may be supplied from either a d.c. source or by means of a galvanic couple set up between the metal to be protected and a more electropositive metal such as magnesium or zinc.

In both cases, an anode must be provided in the soil. In the case of an external d.c. source, the anode may be any sort of scrap metal—old rails, old pipe, etc. Under conditions of cathodic protection it is the inexpensive anode, rather than the costly metal equipment which will be corroded.

In general, the impressed potential will exceed the corrosion potential somewhat so that there will be flow of current into the metal to be protected. The underground equipment is made cathodic to the soil and is, thus, protected from corrosion.

Technically, it does not matter what source of electric current is selected. Economically, however, there is a very great difference. Basically, four different sources must be recognised.

1. Externally generated current. This is normally supplied as a.c. and must therefore be rectified. 2. Current which is generated on location. 3. Galvanic anodes. 4. Storage batteries.

At least one gas pipeline has, furthermore, used a fuel cell in cathodic protection service since early 1961.

In choosing among these sources, controlling considerations are amount of power required, soil resistivity, topography, and accessibility for maintenance purposes. Of much importance is dependability of the power source, for intermittent operation of a cathodic protection system leads to quite unsatisfactory results.

Except in unusual circumstances, the requirements of pipeline equipment are satisfied by galvanic anodes or by purchased power. Only for occasional equipment at considerable distance from the plant may it be necessary to install a separate generator *e.g.*, a gasoline-driven unit. Isolated spots, requiring application of only small current are sometimes even satisfied by the use of batteries.

In general, galvanic anodes find their best field of usefulness where only a small current is called for; *e.g.*, for the protection of coated equipment. They can hardly ever compete with generated power for the protection of large surfaces or of exposed or poorly coated metal. Use of galvanic anodes is not advisable in soils of high resistivity. Olson and Evans[1] recommend an upper limit of 3,000 ohms per cu.cm. soil for magnesium or aluminium and 1,200 ohms per cu.cm. for zinc anodes.

Comparing the different metals—magnesium, aluminium, and zinc—which are commonly employed as galvanic anodes

in cathodic protection service, these authors draw the following general conclusions: Magnesium, because of its high driving potential relative to iron, is desirable in applications where there is a high corrosion potential as well as in soils of high resistivity.

Zinc is most useful where the corrosion conditions are less drastic and where soil resistivity is fairly low. But it has the advantage of offering higher anode efficiency. Zinc will not lead to the considerable degree of over-protection which often leads to excessive magnesium consumption, especially in low-resistance soils.

Aluminium is intermediate between magnesium and zinc in its properties. Anode efficiency has been stated to be nearly equal to that of zinc, but its driving potential is below that of magnesium. On a price basis, aluminium scrap compares favourably with the other two metals used widely in galvanic protection. Such a price comparison must, of course, be based on the amount of metal dissipated per useful A-year. This increases in the order aluminium —magnesium—zinc.

Installed later

The majority of cathodic protection systems have so far been installed a considerable time later than the equipment to be protected, *i.e.*, at a time when it became apparent that advanced corrosion made reconditioning imminent. In that event, the cost of the cathodic protection system is immediately justified on the basis of the reconditioning costs.

More recently, some structures have been provided with cathodic protection at the time of installation, especially in soils of low resistivity where trouble may arise as soon as 1-2 years after first exposure.

From a technical point of view, it is simpler to determine the protection requirements in the former instance. A survey of long-installed equipment reveals size and distribution of electric potentials and required currents after a natural balance between corrosive forces has been established.

As a first step, it is desirable to inspect the state of the subterranean structure to be protected. Where visual inspection by excavation is feasible, the necessary inspection points should be equally spaced. In addition, spots should be inspected where local conditions, *e.g.*, water-logging or nearness to electrified lines, must be suspected of causing high corrosion rate. At such excavation, the entire circumference of the equipment must be inspected. About 10 sq. ft. of metal surface should be viewed.

Electrical methods

More commonly, however, visual inspection is not possible. In such event, electrical methods of determining the corrosiveness at various points must be applied. Such methods are necessary in any event to provide a quantitative basis for designing a cathodic protection system which will operate adequately but without excessive power consumption.

Specifically, these are the basic data required for designing a cathodic protection system[2]:

1. Dimensions of equipment to be protected, together with material of construction, extent of protection by coating, etc.
2. Definition of the section which is to be protected.
3. Data on soil resistance along the section to be protected and at the points where the anodes will be earthed.
4. Data on the conductivity of the protective coating of the section to be protected.
5. Minimum protection voltage or sometimes, instead of this, the minimum current density.
6. Maximum protection voltage.
7. Information on the presence and magnitude of nearby current sources which may influence the protection system.

Of these items, the first two cover information which must be procured by standard methods of inspection at the site, together with application of engineering judgment. The remaining items require specific electric measurements, using methods developed specifically for the needs of cathodic protection.

Numerous considerations enter into the choice of field instrument. Among them are factors of damping—needed if buried electric lines near the area of investigation may originate fluctuating stray currents. Other factors include sensitivity, ruggedness, and portability of the instrument.

Almost all d.c. instruments used in cathodic protection field work are of the moving-coil type. But within this family, Miller[3] recognises four types of millivoltmeters, to wit: Low-resistance instruments (for 10-50 volts), high-resistance instruments (.01-10 volts), potentiometer voltmeters (used over a wide range of potential with the advantage that no current is drawn—but subject to considerable error unless expertly used) and vacuum-tube voltmeters (minimise error, but of limited applicability in cathodic protection work because of instability and frequent need for repair).

These instruments find specific applications in the different potential difference measurements which must be made.

Field methods

Pritula[2] and Parker[1] have compiled field methods of survey which serve for accumulation of the electrical data needed for design of a cathodic protection system. Following are some of the main steps involved:

1. *Soil resistivity.* Laboratory determination is possible, but measurement *in situ* provides more reliable measurement.

2. *Potential surveys.* The needed measurements include determination of potential differences in the following systems: Metal-to-soil, metal-to-metal, metal-to-anode, earth potentials, IR drops.

3. *Minimum protective potential.* Parker[4] states that a voltage of .85 should be applied to coated steel and that the cost of a careful survey needed to lower this value is rarely repaid except in the case of bare or very poor coated pipe. Still, such a survey will be needed for applying cathodic protection to installed metal structures, since the condition of their coating cannot be accurately gauged.

4. *Maximum potential.* Aside from considerations of power consumption, physical restrictions limit the permissible applied voltage in cathodic production. At very high voltages (2-4), adhesion of bituminous coatings may be made nearly useless in one to two months.

5. *Stray currents.* Some electrical systems may set up underground currents which can cause serious corrosive damage to nearby metal structures. Furthermore, a cathodic protection system itself may cause damage to neighbouring underground equipment which is not intended for inclusion in the protective system. By use of recording meters, the magnitude of fluctuations can be readily determined and the source of the stray current can often be located.

Determination must be made not only of the amount but also of the distribution of current required for full protection.

Cathodic protection of a system will affect—usually adversely—all unprotected metal structures within its electric field. Steps must be taken to minimise the occurrence of this effect and to offset it by proper shielding where it does occur.

Several courses are open to suppress the anodic corrosion which occurs in sub-soil structures adjacent to cathodically protected equipment. First, of course, coating should be provided to the affected metal. Beyond that, it is frequent practice to provide a drainage bond between protected and unprotected lines.

In effect, this is a well insulated metallic conductor which will carry most of the current between the lines instead of permitting its passage through the soil. Sometimes, such a bond is not feasible because of local conditions. In that case, shielding may provide the needed remedy.

Location and design of protective anodes in the soil are of very considerable importance. Improper grounding of anodes is the greatest source of power loss in the entire cathodic protection system. Resistance to flow of electricity to the soil should be low and location must be selected for best distribution of the current to all the corroding areas which are to be protected, allowing for the shielding effect of nearby structures.

The preferred approach is therefore to provide a multiplicity of anodes at fairly close distance. The problem is simplified when the areas of greatest corrosive attack have been located, in which event the anode is placed at a nearby point where soil resistance is low.

The anode itself may be made of iron or steel scrap, of carbon or graphite rods or, in the case of galvanic protection of inexpensive shapes of magnesium, aluminium, or zinc. They are surrounded by coke breeze or by loose soil treated with chemicals to raise the conductivity (the most critical resistivity is in the immediate vicinity of the anode proper).

Provision must be made for removal of corrosion products from the zone which immediately surrounds the anode. In the case of carbon anodes, there is no problem since the 'corrosion' products are gaseous. The surroundings of metallic anodes should be assured of moisture and of adequate supply of replacement water. Also, to prevent excessive loss of water (which has a critical influence on soil conductivity), anodic current density should be held low.

In the last analysis, of course, a cathodic protection system must be justified on its economic merits. Here, consideration must be given to the anticipated life of the structure without cathodic protection, the cost of replacement or of defects if not repaired, the need for uninterrupted service from the metal structure, and the cost of maintenance.

In the case of cathodic protection intended for new structures, several additional factors come into play. Thus, a cathodic protection system may make it permissible to use thinner or less expensive protective coating. Use of thinner metal may be made feasible when cathodic protection reduces the amount of needed corrosion allowance.

These factors must be evaluated and balanced against the cost of cathodic protection systems and their operation so that the most economic long-term solution may be provided for the installation.

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[3] M. C. Miller. Reference 1, loc. cit.
[4] M. E. Parker. Pipe Line Corrosion and Cathodic Protection, Gulf Publishing Co., Houston, Texas, 1954.
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Testing refractory bricks

A NEW British Standard dealing with the classification, sampling and testing of insulating refractory bricks has been published (B.S. 2973).

The foreword points out that the first consideration in selecting the most appropriate insulating refractory for any application must be the limiting service temperature. For any given limiting service temperature, the values for other properties may differ in materials of different manufacture, and the refractory material should be selected with the combination of properties most suitable for the application in question.

The system of classification specified in this standard is based on the behaviour of the refractory material in the permanent linear change test.

Copies of this Standard may be obtained from the British Standards Institution, Sales Branch, 2, Park Street, London, W.1, price 6s. each (postage will be charged extra to non-subscribers).

WELDING RESEARCH

THE 16th annual report of the British Welding Research Association shows that the income, at £265,379, was an increase of £27,925 over the previous year, partly as a result of the success which attended the Association's appeal of 1959 to members to increase their subscriptions, and partly from the entry of 41 new members during the year under review.

The enrolment of 60 new research and advisory workers, and the completion in 1961 of a 21,000 sq.ft. engineering laboratory have enabled existing lines of research to be expanded and some important new lines to be developed.

Particular emphasis has been placed on the study of heat-affected zone cracking in heat-resisting steels, which is directly applicable to problems associated with power generation, and extensive use of electron microscopy has been made in this field.

Further investigations of the electric arc and of the efficiency of the gas shield during welding have been made and a technique for measuring the degree of absorption of hydrogen by the weld pool has been developed.

The demand for resistance welding research has more than doubled during the year.

From a paper read to the Midland Junior Gas Association.

The use of corrugated sheeting on a gasworks

By J. K. CRANE, M.I.GAS E., M.INST.F.,
DEPUTY ENGINEER AND WORKS MANAGER,
SWAN VILLAGE WORKS, BIRMINGHAM DIVISION,
WEST MIDLANDS GAS BOARD.

ASBESTOS-CEMENT, aluminium and other forms of corrugated sheeting are now increasingly used for roofing and wall cladding in the construction of gasworks structures.

Such materials, as well as being waterproof, should be durable, of good appearance before and after weathering, and have low maintenance cost. In addition, to be of low weight, have a high fire resistance and good thermal insulation, and be of good mechanical strength, are desirable characteristics.

The protected metal type of sheet has been manufactured for over 50 years, and its widespread adoption for industrial buildings is mainly on account of its low cost, durability and strength. Its natural colour is black, but its post-war usage by the architectural profession for public buildings has led to its manufacture in a variety of colours.

Three main types

There are three main types: Type A is manufactured from steel core corrugated sheets of 20, 22 or 24 gauge, covered with a thin coating of carefully blended bitumen adhesive by complete hot immersion. Protective felts, manufactured from a unique asbestos-bitumen composition are applied to both sides. The top side felt is folded around all edges of the steel core, lapped over the edges of the underside felt, and the whole then consolidated by heat and exceedingly high hydraulic pressure. The final sheet has 11½ 3-in. corrugations.

For Type B, a similar steel core is immersed in hot bitumen and then enclosed in an envelope of tough asbestos felt impregnated with bitumen. A third coating of weather resistant bitumen is then applied, and the sheet is rolled to produce a finished product of black colour only with either 12 2⅝-in. corrugations or a troughed profile.

Type B1 is a development of type B, and is available in colour. In its manufacture the first dip is in molten zinc instead of bitumen, and the final outer coating is in coloured plastic, which is said to age-harden within a few weeks and become virtually infusible. The conventional hook fixing bolt is replaced by special fixing clips and screws of aluminium or stainless steel.

Types A and B of protected metal have been used at Swan Village, and the experience gained from their use shows that if the conditions are severe, due to the presence of sulphurous fumes, or wet coke, or spent oxide dust, corrosion of the steel core can extend sufficiently along the sheet to reach the hook bolts after about eight years. Contributing factors are damage to the ends of the sheets by rough handling before and during erection, and lack of, or careless cleaning of gutters, where the corrosion is often noticeably worse.

It is understood that the method of manufacture of one of the sheets was recently altered to eliminate this weakness. After about eight years, too, the galvanised steel washers of the fastening heads, although treated with mastic at the time of fixing, will in many cases have disappeared.

The surface corrosion on the sheets has been found to be confined to the weather side, and, except for isolated cases, is clearly due to foot traffic or the movement of materials.

Whichever type of protected metal sheeting is being used, the method of fixing is all important. The head of the hook-bolt and the exposed steel core of the sheet where the hole for the hook-bolt has been made, must be protected with the sealing mastic which the sheet manufacturers supply. The shank of the hook-bolt should be deeply dipped into the sealing mastic before it is pushed through the sheets.

Annual inspection

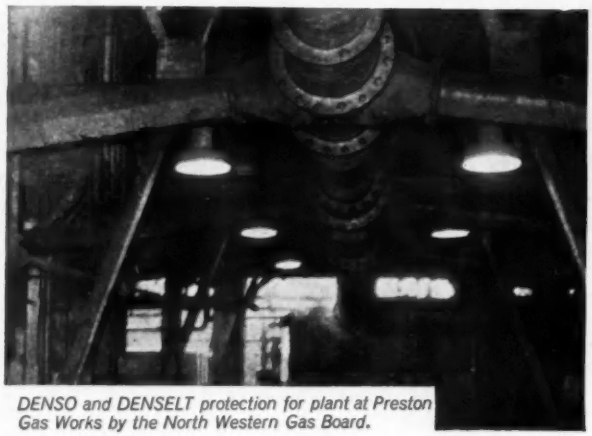
If the sheeting is being done on a contract basis, it is essential to watch this carefully. More sealing mastic, or a fibre washer should then be applied on the upper side, followed by the metal washer and nut. The fastening head should then be brushed with the mastic. A similar procedure should be followed for seam bolts. It is equally important to brush with mastic, all sheet edges which have been cut on site, or damaged during erection.

If these precautions are taken during fixing, some makers are prepared to guarantee their sheets for a surprisingly long time, if they are advised when fixing is taking place. The eventual life of the sheet is undoubtedly determined at this stage.

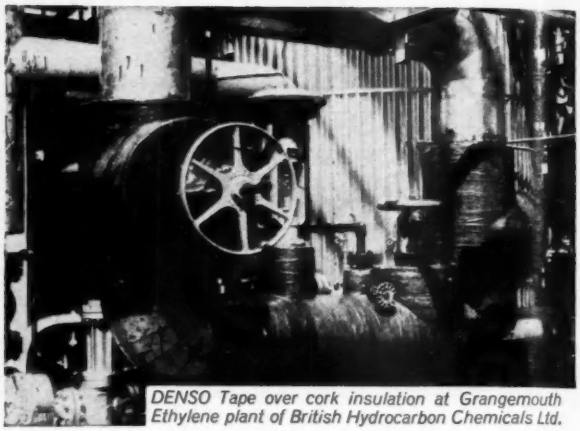
Under gasworks conditions it is essential to inspect the sheets at least annually from the time of erection, and to wire brush, and treat with mastic any spots where the start of corrosion can be seen. Special attention should be paid to the ends of the sheets where any signs of the felt lifting from the core should be remedied by inserting mastic between the two and pressing together.

The satisfactory condition of a lift shaft built in 1937 can be attributed to good fixing of carefully handled sheets which have subsequently been out of harm's way, and is proof that at least a life of 25 years is attainable with this type of sheet.

There's a DENSO



DENSO and DENSELT protection for plant at Preston Gas Works by the North Western Gas Board.



DENSO Tape over cork insulation at Grangemouth Ethylene plant of British Hydrocarbon Chemicals Ltd.

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DENSO MASTIC used for duct sealing at a sub-station by the Eastern Electricity Board.

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The condition of an oxide stocking frame on the other hand which has deteriorated rapidly in eight years shows the effect of adverse conditions, and incidentally, raises the point of why such a structure should be clad at all. The baskets of oxide could be stacked equally well within the shell and without the cladding, and would allow the remaining steelwork to be properly painted.

Asbestos cement is Portland cement which is reinforced with approximately 15% of asbestos fibres to enable the sheets to be handled and moulded while green, and later to be transported and fixed.

Because of the statutory requirements and the recommendations of the Institution, there is a tendency to avoid the use of this material, and therefore to disregard some of the very commendable features it possesses. For, although its durability depends to some extent on the acidity of the atmosphere and it becomes increasingly brittle with age, it can have a life of at least 25 years, during which it will retain a reasonable appearance. It is obtainable in various colours, and is one of the cheapest coverings available.

Experience with asbestos cement at Swan Village has shown that the method of fixing is of the utmost importance. The standard method is by $\frac{5}{16}$-in. galvanised steel hook bolts, with the nuts bearing on purpose-made washers to ensure that the bolt holes are weatherproof.

Corrosion of bolts

Without further protection the life of galvanised hook bolts and washers on a gasworks can be anything from eight to 20 years.

Since there is no steel sheet core to be sealed during fixing, no protective mastic is usually at hand in which to dip the bolt and paint the exposed hook bolt thread, washer and nut.

Thus, although the fibre washer seals the hole on the outside of the sheet, it does not seal it on the inside, and, given the right circumstances, corrosion of the hook bolt where it passes through the sheet will follow.

Usually the outside of the bolt disappears first, and so there is then nothing left to hold the sheet. For men to work on an asbestos-cement covered structure requires special precautions, so the renewal of the hook bolts is a difficult and costly job.

The use of aluminium hook bolts, with a P.V.C. covering where necessary, should give the fixing device a life equal to that of the sheet, and that should be the aim at the design stage. There is also a plastic washer available in place of the conventional metal and fibre washers, which, fitted on its upper side with a boss for a plastic cap, covers the nut and protruding end of the hook bolt, and gives complete protection from the atmosphere.

Vulnerable to impact

The main disadvantages of the actual sheet are its vulnerability to impact—so its use should be avoided where this is likely to happen—and a liability to split caused either by a slight shrinkage of the sheet, or by the movement of the structure if the sheets are fixed too rigidly. The large corrugated sheets are therefore available with wire reinforcement as a protection against total collapse, or men undertaking repairs falling through the roof.

The danger to life if a sheet should fall due to corrosion of the fastening head of the hook bolt is obvious, and it would be far better to support the weight of the sheets, and hold them in position by specially designed, horizontal aluminium rails.

The light weight, attractive appearance, and resistance to atmospheric influences displayed by aluminium has accounted for its introduction by the architectural profession as long ago as 1926. Ordinary commercial 'pure aluminium' contains 99.0-99.4% aluminium. The simplest wrought alloy, NS3 of B.S. 1470, the one used for corrugated aluminium sheet, is made by adding about 1.25% of manganese, and gives a metal of enhanced strength with only a small loss of ductility and corrosion resistance.

With 3-in. pitch corrugations and the same profile as a galvanised steel sheet, it is used in 22- or 20-gauge thickness for roofing, but the spaced Mansard corrugated sheet, intended for side cladding, is less rigid than the 3-in. pitch. Other profiles of troughed form are also available, and the manufacture of all sheets and accessories is covered by a range of British Standards which are listed in the B.S. Code of Practice 143, Sheet Roof Coverings Part 1, 1958, Aluminium Corrugated and Troughed sheet.

Electrolytic action

Though experience with aluminium sheet at Swan Village only dates back to 1955, the important lesson learned is that it must be used in accordance with the instructions contained in this B.S. Code of Practice.

Failure to do so is likely to be the cause of corrosion of the aluminium from electrolytic action where it is in contact with a metal of appreciably different electrochemical potential. In contact with copper or brass in a moist atmosphere, and on a gasworks, especially in such buildings as a retort house, corrosion can occur when the aluminium sheet is in contact with steel purlins or lead flashing, unless the precautions outlined in the Code of Practice are observed when fixing.

Aluminium surfaces away from the areas of galvanic attack quickly become covered with the usual protective insoluble film of oxide, and the rate of corrosion decreases rapidly after the initial stages unless the film is disturbed. Dispersal of the film by the presence of chlorides, which may lead to the formation of aluminium chloride—and later aluminium hydroxide and hydrochloric acid which will continue the attack—is most likely to occur in the laps and on the inside surfaces of sheets used on such buildings as retort houses or coke screening plants where conditions are particularly aggressive.

Precautions taken

Following some failure of 22-s.w.g. sheets after three years from such attacks certain precautions, based on B.S. C.P. 143 are now taken when fixing the sheeting. They are:

1. Only 20-s.w.g. sheet is used.
2. The interfaces of side and end laps are painted with a zinc chromate primer.
3. Only aluminium alloy hook bolts and seam bolts are used. The hook bolts may have a P.V.C. covering, and a bituminous felt washer is always fitted.
4. The purlins are painted with a zinc chromate primer, a dielectric compound, and a bituminous aluminium finishing coat, thus avoiding the use of lead based paints.
5. Under extreme conditions an adhesive bitumen impregnated tape, slightly wider than the purlin should be interposed between the top surface of the purlin and the aluminium sheet.
6. If lead flashing is used the interfaces should be treated with bituminous paint, but it is preferable to avoid the use of metallic lead. Instead a super purity aluminium or lead-lined hessian base damp course, which has a bitumen coating, may be substituted.

So far, by adopting the above precautions, corrosion

appears to be successfully reduced even in the severest of atmospheres.

The original corrugated iron sheet was first manufactured about 1850 from wrought or puddled iron, corrugated in the black, and galvanised by hand dipping. From all accounts it was excellent material, and had a life four times that of the steel sheet which began to replace it about 1880. The materials, profiles, sizes and galvanising are now controlled by B.S. 3083—1959.

The most used is the 'ordinary corrugated' with ten corrugations of 3-in. pitch and ¼-in. depth; the 20-s.w.g. sheet is usual for roofing, and the 22-s.w.g. for side cladding. The weight of the galvanised coating varies between 1½ and 2½ ounces per sq.ft.—both sides included—according to the quality specified.

Painting is essential when this type of sheet is used on a gasworks, and any initial saving in cost over aluminium or protected metal, will have been expended when it has been painted on the second occasion—after six to ten years according to the severity of the atmosphere.

Translucent sheeting

Translucent sheeting—corrugated acrylic sheet—is made in a wide range of profiles. It can be used in conjunction with most types of corrugated sheets for the admission of light. It has been used extensively at Swan Village, but when fixing, a $\frac{7}{16}$-in. hole should be drilled for a $\frac{5}{16}$-in. hook bolt, and a soft washer fitted between the sheet and metal washer. The bolts should be tightened little more than hand tight. This will accommodate and cushion the thermal expansion of the sheet which is four times that of aluminium, and eight times that of steel.

The choice of roofing and cladding material deserves far more consideration than it is usually given, and in many cases the cheapest material may, in fact, be the most suitable.

Considerable thought should be given to the choice of sheet, but twice as much should be given to the method of fixing.

DISCUSSION

Mr. R. N. Hateley, Birmingham, referring to Mr. Crane's emphasis on the proper fixing of all types of sheeting—for asbestos cement sheeting he had recommended the use of PVC-covered aluminium hook bolts—enquired how the cost of such bolts compared with that of ordinary galvanised steel hook bolts. He agreed that from his own experience, aluminium sheeting was liable to corrosion in a very short time. He also asked what was the method of protecting the bolt holes in protected metal sheeting against corrosion.

Mr. Crane replied that the PVC-covered aluminium hook bolts were approximately three times the cost of the ordinary type of galvanised steel hook bolt. The protection of the steel core of a protected metal sheet where the hole for the hook bolt has been punched, or preferably drilled, was by means of the special sealing mastic which the sheet manufacturers supplied. The shank of the hook bolt should be well dipped into this mastic before being pushed through the sheet. This left a deposit of mastic around the hole which seals the core and hole. More sealing mastic, or a fibre washer should then be applied on the weather side followed by the metal washer and nut. Finally, the fastening head should be brushed with the mastic.

Mr. W. E. Dobson, Birmingham, agreed that it was essential for corrugated sheeting to be properly fixed, but with the type of labour at present available, a good reliable job was not always possible.

He asked Mr. Crane, with his accumulated experience, whether he would recommend a type of sheeting for any future job.

Mr. Crane said the situation and atmosphere would decide his choice. Provided no one was going to walk on the roof, asbestos cement was good value for money as long as the fastenings could be relied upon to have a life equal to that of the sheet, say 20 to 25 years, The comparison between protected metal and aluminium was more difficult because his experience with the latter was limited, but with proper fixing the best quality protected metal undoubtedly had much in its favour.

Mr. S. Brockbank, Newcastle-under-Lyme, pointed out that at one time it was customary to use slates for roofing and these required little maintenance. He asked why more purlins could not be used for asbestos cement roofing.

Mr. Crane replied that he did not consider that more purlins were the answer. If the roof was to withstand foot traffic, a covering other than asbestos cement should be used.

Mr. J. R. Kilvert, Birmingham, said that translucent roofing was widely used because it admitted light, but asked for Mr. Crane's views on the best method of cleaning it, bearing in mind such locations as the roof of a c.w.g. plant where it would quickly become coated with dust.

Mr. Crane said that I.C.I. published a leaflet giving hints on the removal of various types of deposit from acrylic sheeting.

Mr. F. J. Bengough, Birmingham, said that despite all precautions taken in the fixing of asbestos cement roofing, it was still liable to crack. At his own works he would not allow this type of sheeting to be fixed unless a 'packer' was used. He agreed that the tapping of the top flange of the purlins was good practice since it could not be painted.

Mr. Crane agreed that it was very important that asbestos cement sheeting should not be fixed too rigidly, but considered that if the fixer knew his job, there should be no need for 'packers'.

Mr. Bengough replied that it was not a question of the competence of the fixer, his point was that it was impossible to tell when to stop tightening the fixing bolts.

Mr. L. H. Hardy, Birmingham, asked whether Mr. Crane considered it necessary to treat aluminium sheeting by Alochrome dipping if it was to be fixed in contact with concrete or mortar.

Mr. Crane agreed that during the setting period, or if subjected to frequent wetting, either concrete or mortar would affect aluminium sheeting, and so he recommended the use of a bitumastic paint as a protection against alkaline attack. He had had no experience of Alochrome dipping.

Mr. G. H. Jacques, Wolverhampton, pointed out that asbestos sheeting should not be fixed so that four sheets met at the corners, since this would quickly become a point of weakness. The joint at corners was usually done by mitring and he asked whether this method could be used with protected metal sheeting.

Mr. Crane, while agreeing that it was inadvisable to fix sheeting so that four sheets met at the corners, said it was preferable to avoid the need for mitring protected metal since, if this type of sheeting was cut, it destroyed the protection of the steel core.

Technical developments

Paint film holiday detector

HOLIDAY detection of the thick bitumen coating of pipelines and tanks is a well known procedure, and has been increasingly accepted as a standard method of testing for a considerable number of years.

In the case of thin paint films, the standard type of high voltage detector is not suitable owing to breakdown of the thin film, and for this reason Mapel have developed a thin paint film holiday detector. This instrument will very accurately determine pin holes, voids or bare spots in a surface coating with a very high electrical resistance when such material is brushed or spread on to an electrically conductive surface such as steel or concrete.

The Mapel paint film holiday detector is not a spark detector, and is non-destructive. The applied voltage never exceeds 70 v. at any time. A flat sponge electrode measuring ½ in. x 6 in. damped with clear water is the inspection electrode. When a fault is encountered in the paint film a small current leaks from the dry cell batteries and signals the presence of the fault by sounding a buzzer in the detector, together with a visual light indication on the unit.

The design of the sponge electrode makes it possible to penetrate orifices and edges. Full inspection is assured because the wet sponge provides a continuous liquid film over the coated area.

The whole unit is extremely light in weight and can be easily held in one hand. Two models are available, one with a pistol grip handle, and the other with a belt attachment which will not hamper the operator's activity on high structures.—*Metal and Pipeline Endurance Ltd.*

New meter indexes

A BASE pressure index and a base volume index for use with high pressure gas meters have recently been marketed. These indexes eliminate the need for the calculations associated with the accurate measurement of gas at high pressures.

The base pressure index automatically compensates for the gas pressure by mechanically multiplying the volume of gas by the pressure factor, and registers the amount of gas at base pressure which has passed through the meter.

The base volume index performs an identical task, and also compensates for temperature.

A supplementary volume and pressure gauge is available for use with both instruments. This gauge plots on a chart the time and pressure at which each 1,000 cu. ft. of gas passes through the meter.—*Parkinson Cowan Gas Meters Ltd.*

Pressure recorder

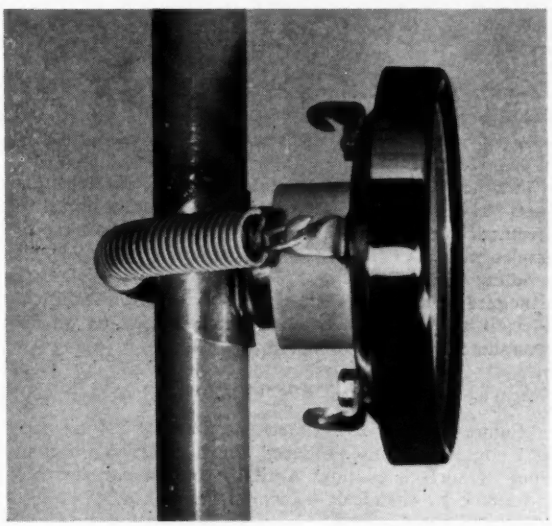
THE Arkon Model 60 pressure recorder is now available for wall mounting. Of sturdy construction, the recorder is driven either by a spring-wound clock or electric motor.

The instrument uses an 8-in. diameter chart having 24-hour or 7-day rotation. It is available for a wide variety of ranges from 5 p.s.i. to 500 p.s.i. and is suitable for the measurement of gas, air, steam, water, oil, and similar liquids.

The recorder has a dust and moisture proof glazed door, fitted with an integral lock, and the chart record is visible at all times. There is also a portable version available which is fitted with handle and stand, its total weight being only 9½ lb.—*Walker, Crosweller & Co., Ltd.*

Surface thermometer

A MODIFICATION to spring fitting pipe surface thermometers, which makes one model adaptable for either horizontal or vertical pipes, has recently been developed. The thermometer now has four hooks, instead of two, at equidistant intervals at the rear of the dial. This



allows the detachable spring, which clamps the thermometer to the pipe, to be fixed to the appropriate hooks, whatever the angle of the pipe.

Previously, with the two-clip model, it was necessary to stipulate a horizontal or vertical model when ordering.

The surface thermometers are designed for use where it is not convenient to insert the thermometer directly into the pipe and are particularly applicable for domestic heating apparatus. A soft copper saddle shaped to the contour of the pipe surface ensures maximum thermal contact. —*British Rototherm Co., Ltd.*

Valve positioner

A NEW valve positioner has been produced, which is designed to a specification which combines requirements of high accuracy, speed and sensitivity, with low air consumption and ease of adjustment. The 3560V/P

has a frequency response superior to that of the Type 3500 which it replaces; its break frequency at 5% of full instrument pressure range has been improved from .15 to 3.9 cycles per second.

Interchangeable characterised cams are used to enable the control valve characteristic to be more closely matched to the process characteristic. Where a characterised cam is installed in place of the standard linear cam, the relationship between instrument pressure and valve plug travel is changed so that greater instrument pressure changes are required to create a given change of flow through the valve. This helps to solve instability problems caused by an oversized control valve.

The 3560V/P can be converted from direct to reverse action, or changed to split range operation by means of a few simple adjustments and without any additional parts.—*Fisher Governor Co. Ltd.*

P.T.F.E. tape

A RECENT addition to the range of P.T.F.E. products manufactured by Turner Brothers Asbestos Co. Ltd., Rochdale, is pipe thread sealing tape. This unsintered tape is supplied as a continuous ribbon ½ in. wide on metal dispensers in lengths of 20 ft., 30 ft., or 40 ft., and is used for sealing threaded pipe joints. Breaking of the connection is easily accomplished, even after a long period of time.

The plasticity of the material ensures that it conforms exactly to the contours of the thread, resulting in a perfect seal against pressures of many thousands of p.s.i. It is also unaffected by temperatures ranging from – 100°C to + 300°C, is chemically inert and will not cause contamination of the substance being handled. Turners P.T.F.E. tape is impervious to water, steam and most corrosive liquids and gases, and is unaffected by ageing or weathering.—*Turner Brothers Asbestos Co. Ltd.*

Cutting machine

THE Pug, a portable lightweight oxygen cutting machine, is now being marketed by British Oxygen. It weighs only 21 lb. and cuts and bevels steel up to 2 in. thick.

Running on inexpensive light alloy track, the machine can make a straight cut of any length. Circles, from 3 in. to 4 in. in diameter, can be cut with the use of an adjustable trammel attachment. The cutter can be moved through angles up to 45° for bevelling and can be adjusted vertically and laterally.

Power is supplied by a universal electric motor which gives a speed range of 7.3 to 36 in. per minute. Speed control is by rotary-type resistance.

The nozzle-mixing blowpipe, for trouble-free and safer cutting, uses acetylene or propane as fuel gas. Another feature is a wrap-round handle for easy carrying and protection.—*British Oxygen Co. Ltd.*

TRADE PUBLICATIONS

Two new publications have been issued, entitled 'Products of the Holmes Organisation' and 'Industrion Electrical Air Filters'. The first of these gives some examples of work performed in chemical engineering, gas handling and gas cleaning. The second booklet details the principles of operation and construction of the Industrion filter; it also describes heavy duty filters and an oil mist precipitator.—*W. C. Holmes & Co. Ltd.*

'Camrex Industrial Maintenance Coatings' is the name of a booklet recently produced which describes the many types of surface coatings available to prevent corrosion and attack by chemicals.—*Camrex Paints Ltd.*

A leaflet entitled 'Rotary Dividers' has recently been published, which describes three sizes of this equipment. The largest is usually incorporated in the main material stream, and is designed to reduce a maximum of 240 lb. of small material to 12 equal samples of 20 lb. each. The smaller sizes, of 100 lb. capacity and 28 lb. capacity, are most popular for laboratory analysis.—*Robert Dempster & Sons Ltd.*

Ward's F.P.I. Department has issued a new booklet, 'Factory Planning and Installation', which with the aid of lavish illustration, gives a comprehensive picture of this service. The first part describes specific contracts which have been carried out, and the second part details the plant and machinery installation service, and illustrates typical examples.—*Thos. W. Ward Ltd.*

A new brochure entitled 'Rectangular Hollow Sections' has recently been issued by Stewarts and Lloyds Ltd., which details the sizes and properties of the sections in the hot finished welded and hot finished seamless ranges produced by the Company. The rectangular hollow section has been developed out of the growing demand for hollow structural steelwork. The technical information describing the properties of these sections is followed by a copiously illustrated part which considers some of the applications of this material.—*Stewarts and Lloyds Ltd.*

A new price list, S.I., of valves and fittings, which is complementary to catalogue S, has recently been issued. This list covers over 155 different types of valves in all sizes. It is fully indexed to assist reference with the catalogue, and gives full technical descriptions of the items it contains.—*Charles Winn & Co. Ltd.*

A new publication from Plenty & Son Ltd. contains illustrations and descriptions of some of the Company's range of pumps and filters, and details other items of equipment which are also manufactured.—*Plenty & Son Ltd.*

A new booklet, 'Talking about Wards', has now been published, which is intended to present a brief outline of the activities of this Company and those other subsidiary and associated companies which together make up the Ward Group.—*Thos. W. Ward Ltd.*

Four-star room heater range

THE SUNBEAM

THIS heater has a built-in draught regulator, a stainless steel control flap, which hangs in front of the flue outlet; it is drawn closer to the outlet as the pull from the flue increases. This eliminates the need for a flue restrictor, and is sensitive to the smallest pressure changes. Approximately equal proportions of radiant

and convected heat are given out, and the thermostat, which is completely automatic, is actuated by the temperature of the room air drawn beneath the heater. Automatic ignition is also fitted, and a device which ensures constant even brightness whatever the heat setting.—*Radiation New World Ltd.*

THE SUNDOWN

HEAT from the radiants of this model is supplemented by black radiant heat emitted from the panel above the radiants; this panel is the front of the vitreous enamelled front heat exchanger box. The products of combustion from the radiants pass into the front heat exchanger and then into the rear heat ex-

changer before being discharged in the flue. Cool air from the room passes between and behind these boxes before being emitted into the room. The thermostat is designed so that the bright circular glow is maintained whatever the setting, and the Sundown is fitted with automatic ignition. —*Parkinson Cowan Appliances Ltd.*

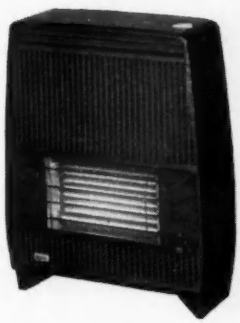
THE DEBONAIR

PLANNED to fit in with contemporary furnishings, this heater has a surround of mahogany or light oak which has a special heat resistant finish. The louvres, of stainless steel, provide the outlet for convected air which is drawn in at floor level. The three radiants are so adjusted that the two outer radiants may

be extinguished leaving the centre at full brightness. A patent ventilation control is fitted at the base of the fire, which enables stuffy or smoky air to be cleared from the room without the need to open windows. Ignition of this new heater is by means of a battery-operated lighter.—*Sidney Flavel & Co. Ltd.*

THE SELSDON

THIS new radiant-convector of the fixed hearth type, is constructed mainly of steel pressings. Claimed to have an efficiency of over 60%, it heats up quickly and gives maximum heat control by means of a high-level graduated tap. The radiants are made of a special refractory material which has a high resistance to



mechanical shock and discoloration; the heat exchanger is constructed of aluminised steel pressings. Gas connections may be made from either right or left or at the back, and the heater has a built-in battery lighter operated by the control tap, which provides automatic ignition.—*R. & A. Main Ltd.*

Gas industry surplus must become a habit, says Sir Henry

NEWS SUPPLEMENT

THE surplus earned by the gas industry last year must become a regular habit if the area boards are to fulfil the requirements of the White Paper on Financial Obligations of the Nationalised Industries, said the Chairman of the Gas Council, Sir Henry Jones, at the Centenary Meeting of the Scottish Association of Gas Managers in Edinburgh.

Said Sir Henry: 'It is not wise to forecast the results for the current year, but I shall be very disappointed if a surplus is not earned again.

'We know at least that the output of gas since April 1 is higher than last year, and that stocks of coke are rather lower than a year ago, both reassuring features of current statistics.

'Looking to the future I am optimistic about gas sales. We are offering gas on competitive terms for many purposes now, but as new plants come into production cheaper gas is going to give better value still.'

The Chairman continued by saying that coal, oil and methane would all form part of their future prosperity, provided the cost enabled them to make gas at a price suitable to their customers.

The gas industry was rapidly changing, but he believed that the next five years would see the costs of gas production and supply steadily falling.

The present small increases in gas sales would then be seen as the forerunner of a new era of expansion for the industry, he said.

'In the short term we have problems to solve. Necessary though the Chancellor's restrictions on the economy of the country may be, they are bound to have some effect on the sales of gas and of appliances.

'It is no consolation to us or to the makers of appliances to know that others are experiencing the same difficulties, and the Gas Council and the area boards are determined to bring about improvements.'

The Centenary Meeting will be fully reported in the September 27 issue of 'GAS JOURNAL.'

Seen at the Centenary Meeting

Sir Henry Jones, Chairman of the Gas Council (second from the left) at the Centenary Meeting of the Scottish Association of Gas Managers. With him are, left to right, Mr. J. H. Dyde, Chairman of the Eastern Gas Board; Mr. H. R. Hart, Deputy Chairman, and Mr. R. H. Bone, Commercial Manager, both of the Scottish Gas Board.

The Sheffield office of George Kent Ltd. has opened at Lloyds Bank Chambers, Earl Street, Sheffield 1 (Telephone Sheffield 77471/2). The branch is under the supervision of Mr. H. E. Farrar, Area Manager, assisted by Mr. G. H. Sharp, Senior Sales Engineer, and is able to provide technical and contracting facilities with the additional support of a district service engineer and team.

PUBLIC LIGHTING CONFERENCE

The Annual Conference and Exhibition of the Association of Public Lighting Engineers will be held in Scarborough from October 3 to 6. The theme of the conference will be 'Colour, Efficiency and Economics,' and there will be displays of equipment for installation and maintenance of lighting.

Exhibition shows central heating

ONE of the main attractions of the Gas Council's two stands at the Public Health Inspectors' Conference and Exhibition at Bournemouth recently was a central heating feature.

Both the warmed air and small bore systems were shown, and experts explained the details of the various installations.

Five different installations were shown: Diplomat 44 S.B. boiler (Thos. Potterton Ltd.); Kingston No. 2 S.B. boiler (Ideal Boilers & Radiators Ltd.); Parkray G.604/1 heating unit (Radiation Parkray Ltd.); G.105-23A unit (Radiation Parkray Ltd.); and Halcyon F.60/W.H. unit (William Sugg & Co. Ltd.).

FILMS FOR ENGINEERS

A LIST has recently been published of civil engineering films that are available from members of the Federation of Civil Engineering Contractors. Two of these films are 'Pipeline into Wales' and 'Pipeline in Pakistan', the first showing the construction of the North Wales Grid, the second the laying of a 350-mile pipeline in Pakistan.

'Opencast Coal Mining' shows the technique of winning opencast coal. The erection of a flare stack at the British Petroleum Company's refinery on the Isle of Grain is shown in 'Flare stacks on the Isle of Grain', and 'Pipeline into Persia' tells of the construction of a 700-mile pipeline between Abadan and Teheran.

Heat Transfer Conference in London

A CONFERENCE on International Developments in Heat Transfer is to be held in London next January. It is being arranged jointly by the Institution of Mechanical Engineers, the American Society of Mechanical Engineers and the Institution of Chemical Engineers.

This follows a similar conference held recently at Boulder, Colorado, U.S.A.

The main subject of the conference will be the fundamental aspects of heat transfer, but radiation, convective heat and mass transfer, condensation and boiling, and conduction and diffusion will also be considered.

The preliminary programme of the London conference, which includes a registration form, can be obtained from the Secretary, Institution of Mechanical Engineers, 1, Birdcage Walk, Westminster, S.W.1.

Power-Gas wins £2 mill. order

THE Power-Gas Corporation, a member of the Davy-Ashmore group, has been awarded a contract worth nearly £2 mill. for the building of a complete ammonia plant to be erected at Grenaa in Denmark.

This plant forms part of a new fertiliser factory for Dansk-Norsk Kvaelstoffabrik of Copenhagen, states the *Financial Times*. Power-Gas is responsible for design, procurement, erection and commissioning.

Coal Board sales drive reaches second phase

THE National Coal Board is preparing the ground for the second phase in its campaign to maintain the level of demand for coal at a constant 200 mill. tons a year.

A vigorous programme, designed to dissuade businessmen from switching to oil and to win new customers among industrial concerns, is now being discussed at Hobart House, writes the Industrial Correspondent of the *Financial Times*.

Lord Robens, the Chairman, has already initiated talks on improved factory boiler design. He wants manufacturers to produce new, trouble-free units that will be capable of burning cheap and readily-available pulverised fuel.

CARRIED IN TANKERS

Use of this coal, he believes, would revolutionise industrial steam raising and heating from the point of view of the N.C.B. and the country as a whole.

Pulverised fuel could be carried in road tankers to customers in any part of the country, at any time.

Expenditure on fuel storage space could be cut considerably, and the risk of delivery delays during the winter months would be reduced to a minimum.

'WELL SATISFIED'

Said Lord Robens: 'So far the campaign has gone remarkably well. We are well satisfied with the progress made on the domestic front, and are confident that we can compete on both heating and price without any worry at all.

'Now we are looking to industry, seeking ways of improving our service and satisfying our customers.'

Lord Robens said that 10 or 12 new solid fuel domestic appliances would be put on the market between the autumn and the spring to take partial and full central heating into modest-income-group homes.

'We are still in the balancing process of keeping our production and sales at a point where we can go on steadily reducing costs,' said the Chairman. 'Now we have to watch carefully the qualities of coal produced, which is a delicate process.

'While we still have stocks on the ground, we have got them to the stage where we can say that they are virtually earmarked for the power stations. Although we must get the stocks down still more, we are now not very far off balance.'

ENGINEERS' REFRESHER COURSE

A COMPREHENSIVE refresher course for Works and Plant Engineers will be held in Scotland this winter. It is organised by the Institution of Plant Engineers, and will meet at the Institution of Engineers and Shipbuilders, Elmbank Crescent, Glasgow.

The course comprises 18 weekly lectures on Wednesday evenings, beginning on November 1. The fee is 4 gns. and copies of the syllabus and full particulars may be obtained from the Secretary to the refresher course, 39, Elmbank Crescent, Glasgow, C.2.

COMPUTER DESIGNS PIPELINES

A COMPUTING machine for designing trunk gas pipelines, and the automation of the piping of gas over various distances, has been built in the U.S.S.R.

This electronic installation, which has already made its first computations, is based on the principle of the analogy between the movement of electric current in a cable and of gas in a pipeline.

Calculations that take 24 hours in the pipeline are made by the machine in 3 seconds. This method of designing makes it possible to dispense with the construction of costly installations for storing gas.

The machine allows trunk gas pipelines to be designed with due consideration for the fluctuations in the expenditure and supply of gas at different times of the day.

IDEAL BOILERS CHANGES NAME

IDEAL BOILERS & RADIATORS LTD., has changed its name to Ideal-Standard Ltd. The Company has given prominence to the name Ideal-Standard and is now identified with that name. For this reason the name has been adopted.

The change does not affect the Company's general policy, management or capital structure.

PERSONAL NOTES

MR. F. BELL, distribution engineer of the Southern Gas Board since June, 1956, is to join the West Midlands Gas Board as Chief Distribution and Installation Engineer. MR. W. H. ELKERTON, commercial manager of the Southern Gas Board, is to join the West Midlands Board as Director of Marketing. The appointments will strengthen the Board organisation in readiness for an intensive sales campaign on all fronts. Mr. Elkerton will spearhead the campaign and will control the marketing of industrial and domestic gas and coke. Mr. Bell will be responsible for the transmission of gas from manufacturing stations, including the new Lurgi plant at Coleshill when it is completed, right through to the customers' appliances. Mr. Bell has been responsible for the integration of the Southern Board's system and the laying of the area gas grid. Mr. Bell was also responsible in the South for the development of unmanned gas holder stations. Mr. Elkerton joined the Southern Gas Board from the Liverpool Group of the North Western Gas Board and was appointed commercial manager in September, 1956, with responsibility for the complete re-organisation of all commercial activities.

Mr. Bell.

Mr. Elkerton.

MR. C. H. SUTTON (45), formerly assistant stores controller and liaison officer for the Mersey Group of the North Western Gas Board, has been appointed Divisional Stores, Purchasing and Transport Officer at Perth for the Scottish Gas Board. He joined the North Western Gas Board as stores controller and purchasing officer for Wirral Group, which was later combined with Liverpool Group to form the Mersey Group of which he was appointed assistant stores controller and liaison officer. MR. W. T. LANE has been appointed Divisional Commercial Sales Officer at Perth. He was formerly operational sales organiser with the South Western Gas Board. Mr. Lane is 53 and has spent all his working life in the gas industry. When the industry was nationalised in 1949, Mr. Lane became publicity officer for the Southern Division of the South Western Gas Board.

MR. J. D. ECCLES has been appointed Director and General Manager of Head Wrightson Stockton Ltd. MR. G. F. TAYLOR has been appointed General Manager of Head Wrightson Steel Foundries Ltd.

SIMON-CARVES WINS CHILEAN CONTRACT

A CONTRACT valued at approximately £200,000 for the design and supply of a coal preparation plant for South America, has been won by Simon-Carves Ltd.

The plant, for Compania Carbonifera e Industrial de Lota in Chile, will be capable of handling 4,400 tons of coal each two-shift day. It includes hand cleaning for the large coal, Baum washing of two different qualities of coals of intermediate size, together with water clarification and coal handling equipment.

The washing capacity is 260 tons per hour of 4-in. and 2-in coals. Of the different quality coals, one is for metallurgical and the other for industrial use.

This is the first contract for coal preparation plant that Simon-Carves has won in South America.

An exhibition was held recently in conjunction with the Association of Teachers of Domestic Subjects Conference. On the Gas Council's stand were shown the visual aids used in schools to illustrate the operation of gas domestic appliances.

COMING EVENTS

October 6. — SCOTTISH WESTERN JUNIORS: 'Work Study in the Scottish Gas Board,' By G. Thompson.

October 10.—MIDLAND JUNIORS: Presidential Address.

October 11.—I.G.E., MIDLAND SECTION: Autumn Meeting. 'Town Gas in the Manufacture of Tubes,' by A. C Jennings and W. C. Waite. 10.45 a.m.

October 12.—I.G.E., WALES AND MONMOUTHSHIRE SECTION: Annual General Meeting, Cardiff.

October 13.—WALES G.C.C.: Tenby. 11 a.m.

October 14.—WESTERN JUNIORS: Bath. Annual General Meeting and Presidential Address.

October 16.—EASTERN G.C.C.; Connaught Rooms, Great Queen Street, London, W.C.2. 11 a.m.

October 18.—I.G.E., SOUTH WESTERN SECTION: Bristol. Annual General Meeting and Address by Chairman.

The D.S.I.R. Headquarters has moved to State House, High Holborn, London, W.C.1. Telephone Chancery 1262. State House is a new 15-storey block about three minutes' walk from Holborn underground station on the north side of High Holborn.

A.P.V. RESUMES INTERIMS

THE A.P.V. Company has resumed interim dividends with 3¼% declaration, the last having been made on account of 1955. The Company's group turnover and profit for the first half of 1961 exceeded those of the corresponding period last year. Providing there is no unforeseen setback, the Directors look forward to continued good results during the remainder of this year.

The Royal Society for the Prevention of Accidents has just published 'Works Accident Statistics, Part 2: Records and Analysis.' The price is 5s. post free (members 3s. 9d.), and orders should be addressed to the Service Department, RoSPA, 52, Grosvenor Gardens, London, S.W.1.

The laying of the final length of pipeline in the Chesterfield district for the gas grid from Thorne (Yorks) to Stoney Stratford (Bucks) has begun. Planning of the route started at the beginning of this year, and the work should be finished by about the middle of November.